United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R06-88/033
June 1988

EPA

Superfund Record of Decision:

ENVIRONMENTAL
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16. Abstract (Limit: 200 words)

The 235-acre Sand Springs Petrochemical site, located in Sand Springs, Oklahoma, is a former refinery and solvent recycling facility that operated between 1900 and the early 1970s. The site is located immediately west of Tulsa along the northern bank of the Arkansas River and consists of unlined acid sludge pits, a surface impoundment, solvent and waste oil lagoons, and several subsurface sludge pits and spray ponds. During plant operations, waste products were disposed of in the unlined pits, surface impoundments [redacted] spray ponds. Primary contaminants of concern affecting the soil, shallow ground water, and sediments were organic solvents and heavy metals. In September, 1987, a source control Record of Decision was signed to control and destroy the major sources of contamination. This second Record of Decision deals with the remainder of the site, primarily snallow ground water and minimally contaminated soil.

The selected remedial action for the remainder of the Sand Springs site is no further action. Based upon the findings of the RI/FS, the Endangerment Assessment for the operable unit concluded that no significant risk to public health or the environment exists. Ground water and the Arkansas River water will be monitored for 30 years after completion of the source control remedial action, and warning signs and fences will be erected as part of this no action alternative. Estimated capital cost of the remedy is $9,300 with annual O&M costs of $45,600.

17. Document Analysis a. Descriptors

Record of Decision
Sand Springs, OK
Second Remedial Action
Contaminated Media: gw, soil
Key Contaminants: metals, VOCs

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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Department of Commerce

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

MAIN SITE (GROUNDWATER) OPERABLE UNIT

SAND SPRINGS PETROCHEMICAL COMPLEX

SAND SPRINGS, TULSA COUNTY, OKLAHOMA

JUNE 1988

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Sands Springs Petrochemical Complex, Tulsa County, Oklahoma. Main Site (groundwater) Operable Unit.

STATEMENT OF PURPOSE

This decision document represents the selected remedial action for the Main Site (groundwater) Operable Unit of this site developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency Plan (40 CFR Part 300).

The State of Oklahoma concurs with the remedy described in this Record of Decision. (Appendix D)

STATEMENT OF BASIS

This decision is based upon the administrative record for the Sand Springs Petrochemical Complex Superfund Site [index attached]. The attached index identifies the items which comprise the administrative record upon which the selection of this remedial action is based.

Based upon the findings in the Remedial Investigation and Feasibility Study for this operable unit, the Endangerment assessment concluded that there are no public health threats from the minimally contaminated soil, groundwater or the Arkansas River. The groundwater and the Arkansas River are not sources of drinking water and sampling of the Arkansas River detected no contamination. The attached correspondence (Appendix B) from the Agency for Toxic Substances and Disease Registry (ATSDR) concurs with this conclusion.

Description of Selected Remedial Action

- The Environmental Protection Agency has selected No Action with long term monitoring, following completion of the source control remedial action, as described in the September 1987 Source Control Record of Decision (ROD). Included in this remedial action is the placement of appropriate warning signs, restricting access and collecting and analyzing groundwater and Arkansas River samples for a period of at least 30 years.

- Potential off-site and/or active facilities which appear to be contributing to groundwater contamination in the area of the site will be further investigated in consultation with the Oklahoma State Department of Health.

- o If, after the source control remedial action, as described in the September 1987 Source Control Record of Decision, monitoring reveals that the site releases contamination such that groundwater or the Arkansas River is adversely impacted, then further action will be considered. If no trend toward adverse impacts is detected, deletion of the site from the National Priorities List will be pursued.

DECLARATION

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by Superfund Amendments and Reauthorization Act of 1986, and the National Contingency Plan, I have determined that the No Action alternative, which includes long term monitoring of groundwater and surface waters, in conjunction with the approved Source Control Remedial Action, will provide adequate protection of public health, welfare, and the environment. This remedy attains Federal and State requirements that are applicable or relevant and appropriate and is cost effective. It is determined that this remedial approach is permanent and the use of alternative treatment technologies have been utilized to the maximum extent practicable.

The state of Oklahoma has been consulted and concurs with this remedial action for the Main Site (groundwater) Operable Unit. The activities outlined in the September 1987 ROD for source control operation and maintenance are incorporated into the selected remedy for the groundwater unit. If contaminants from the site are detected during a monitoring period which appear to be adversely impacting the groundwater or the Arkansas River, an investigation will be initiated to determine the need for future action. For such case, a Record of Decision must be prepared for any additional future remedial action(s).

6/28/88
Date

Robert E. Layton Jr.
Robert E. Layton Jr., P.E.
Regional Administrator

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EXECUTIVE SUMMARY

The Sand Springs Superfund site is located in Sand Springs, Oklahoma. The site is the former location of the Sinclair Refinery which operated from the turn of the century through the 1940's. After the refinery was shut down, most of the property was conveyed to the Sand Springs Home. In 1968, Sinclair merged with Atlantic Richfield Company (ARCO) and the remaining 38 acres retained by Sinclair were absorbed in the merger. The portion of the complex identified in the Remedial Investigation/Feasibility Study as the Glenn Wynn site operated as a solvent recycling facility during the late 1960's and early 1970's.

The total known waste volume is approximately 130,000 cubic yards. Unlined sludge pits on the site contain several thousand cubic yards of sulfuric acid sludge. In addition to these wastes, the lagoons, pits, and spray ponds on the site contain various heavy metals and organics.

A Source Control Record of Decision signed in September 1987 dealt with controlling or destroying the major sources of the contamination. This Record of Decision will address the remainder of the site, which includes minimally contaminated soils and groundwater contamination.

Based on the findings in the Remedial Investigation and Feasibility Study for this operable unit, the Endangerment Assessment concluded that there are no public health threats from the minimally contaminated soil, groundwater or the Arkansas River. The groundwater and the Arkansas River are not sources of drinking water and sampling of the Arkansas River detected no contamination. Also it was discovered that much of the site and surrounding area contains high inorganics or metals possibly due to local smelter operations. The site is also being impacted from offsite sources of organics, primarily solvents.

Of the four alternatives proposed for detailed analysis, the Environmental Protection Agency (EPA) has selected No Action with monitoring, following the Source Control Remedial Action. The site would be monitored for at least 30 years. The estimated cost of this alternative is $440,000. Potential off-site and/or active facilities which may be contributing to groundwater contamination in the area of the site will be further investigated in consultation with the Oklahoma State Department of Health.

Summary of Remedial Alternative Selection
Groundwater Operable Unit for
Sand Springs Petrochemical Complex
Tulsa County, Oklahoma
June 1988

I. SITE LOCATION AND DESCRIPTION

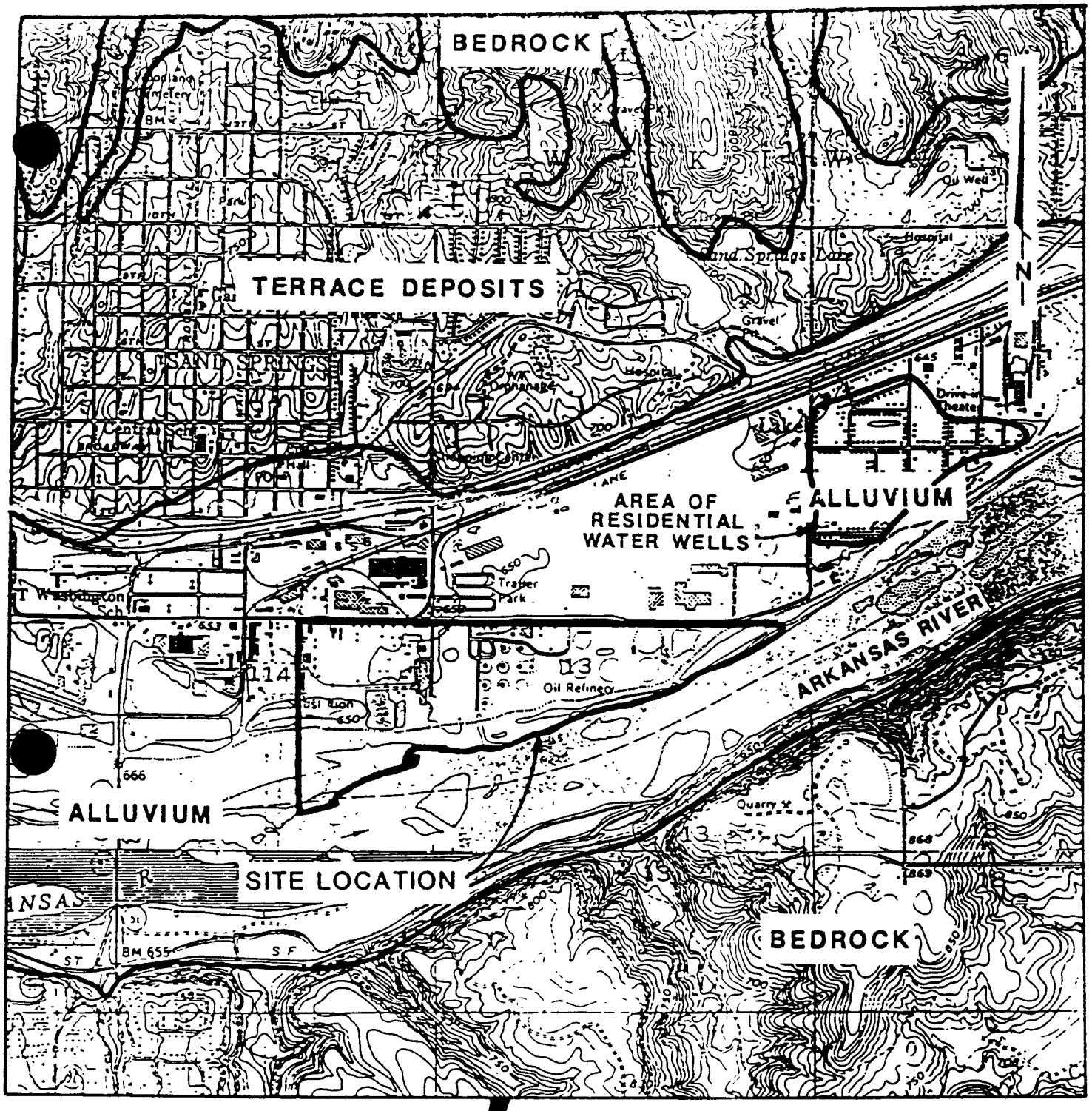
The Sand Springs Petrochemical Complex Superfund site is located in Sand Springs, Oklahoma. As shown in Figure 1 the site is located on the northern bank of the Arkansas River, immediately west of Tulsa, Oklahoma. The site encompasses approximately 235 acres and is the former location of a refinery. As shown in Figure 2, the site includes unlined acid sludge pits, a surface impoundment, surficial sludge contamination, solvent and waste oil lagoons and contaminated sediments and several subsurface sludge pits and spray ponds. The Source Control Operable Unit Remedial Investigation and Feasibility Study and Record of Decision (ROD) further describes the sources of contamination and the selected remedial action for them. In general the ROD called for removal and treatment of the sources of contamination. The site is situated in a sandy alluvial deposit with a thickness ranging from 25 to 41 feet. This deposit is underlain by approximately 100 feet of shale. Pits and lagoons have contaminated shallow groundwater.

In September 1983 the site was proposed for inclusion on the National Priorities List. Promulgation of the site was in June 1986. In June 1984, the Oklahoma State Department of Health (OSDH) entered into a Cooperative Agreement with EPA to conduct the Remedial Investigation/ Feasibility Study (RI/FS) at the site. Utilizing funds from this Cooperative Agreement, the OSDH contracted with John Mathes and Associates to perform the sampling, analysis, and technical assessments of the site.

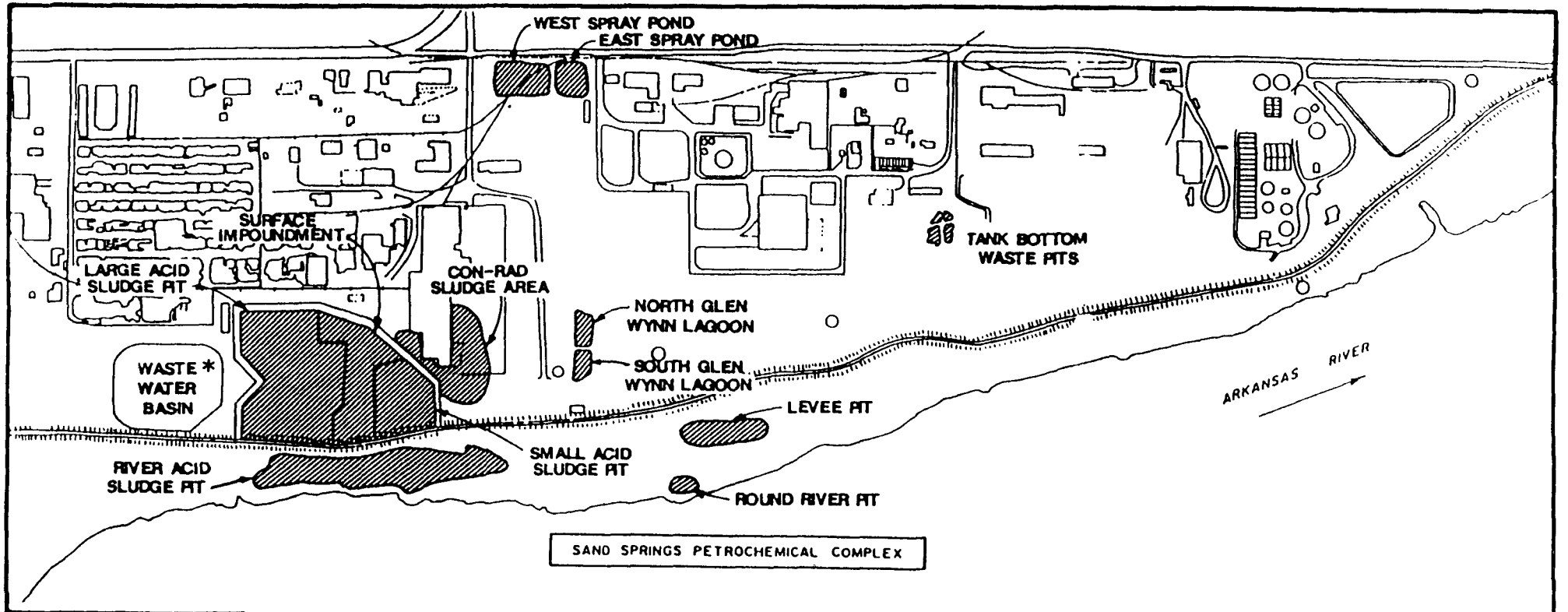
In an effort to address the obvious contamination in an expeditious manner, a source control operable unit was established to focus on the waste in the pits, ponds, and lagoons. The Source Control Record of Decision addresses those sources of contamination. The remainder of the site, primarily the groundwater, is addressed in the full or "Main Site" RI/FS dated March 1988 and April 1988 respectively.

Hydrogeologic setting

The Sand Springs Petrochemical Complex is adjacent to the Arkansas River on an alluvial flood plain. A geologic cross-section of the site is presented in Figure 3. The thickness of the alluvial materials, based on boring logs from the site, ranges from 25.0 feet to 41.2 feet. In general, the alluvium thickness averages 35-40 feet near the river



John Mathes & Associates, Inc.	
SURFICIAL GEOLOGY OF SAND SPRINGS PETROCHEMICAL COMPLEX AREA	
12862459	FIGURE 1



EXPLANATION

DISPOSAL AREAS WITHIN THE SOURCE CONTROL OPERABLE UNIT

* HOLDING BASINS FOR WASTE WATER TREATMENT PLANT OVERFLOW

SOURCE: John Mathes & Associates, Inc., 1987d.

12862459

FIGURE 2

WASTE DISPOSAL AREAS

John Mathes & Associates, Inc.

and decreases to the north. The alluvial materials primarily consist of silt and fine- to medium-grained sand. Terrace deposits, primarily thick alluvial deposits of fine- to medium-grained sand, exist just north and upgradient of the site.

The alluvial groundwater is recharged by infiltration of rainfall and surface water through the Newblock Park terrace and Arkansas River alluvium. This recharge is expected to add to the amount of groundwater flow beneath the site, which based on measured groundwater flow conditions, discharges into the Arkansas River. Figure 3 is a generalized geologic cross section through the Arkansas River Valley illustrating the spatial relationship between the terrace deposits and flood plain alluvium.

The lateral hydraulic gradient (slope) within the alluvium deposits is based on fluid elevation measurements. Based on monitoring well measurements, the direction of groundwater flow was found to be toward the Arkansas River. These measurements coincide with conclusions presented in Tulsa's Physical Environment (Tulsa Geological Society, 1973) that the Arkansas River is predominately an effluent stream. The groundwater flow velocity in the alluvial materials is estimated to be in the range of 198 to 764 feet per year.

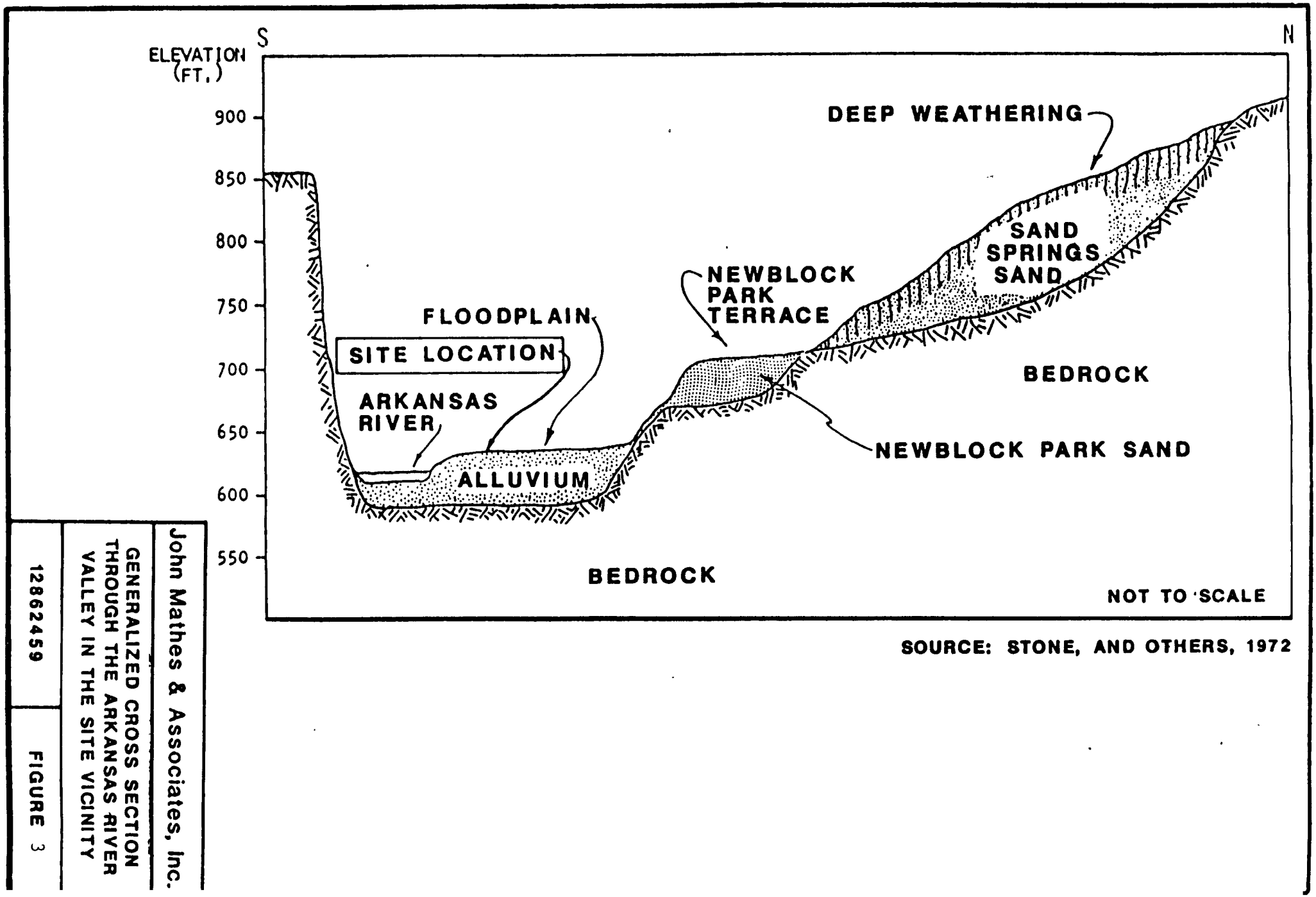
The uppermost bedrock underlying the site is the Coffeyville Formation, which is composed of shales, thin bedded sandstones, and siltstones. The portion of the Coffeyville Formation underlying the site is estimated to be approximately 280 feet thick (OSDH, 1986b).

Insitu aquifer tests performed at the site indicate high hydraulic conductivities. Based on these tests the alluvial aquifer appears to be very consistent in hydraulic conductivity throughout the site. Measured hydraulic conductivities ranged from 403 to 1272 (gallons per day/per square foot). Hydraulic conductivity data for the Coffeyville Formation is not available, but field observations of rock cores and borehole tests indicated hydraulic conductivities to be several orders of magnitude lower than for the overlying alluvial deposits. The difference in hydraulic conductivity indicates that movement of contaminated groundwater will primarily be lateral within the alluvium. The extremely low hydraulic conductivity of the underlying shale will restrict the infiltration of groundwater from alluvium to bedrock.

Main Site remedial investigation summary

During the Main Site RI of the Sand Springs Petrochemical Complex, samples were collected of soil, surface water, groundwater, and soil gas to evaluate if significant pollutant concentrations are present.

Groundwater monitoring well installation, groundwater sampling, and water level monitoring were performed in two phases of the investigation. Phase I occurred during the summer of 1986 and Phase II occurred during early 1987. A total of 24 monitoring wells were installed during both phases. These 24 new wells and the 11 existing wells installed by U.S. Environmental Protection Agency (EPA) contractors were sampled for this RI.



SOURCE: STONE, AND OTHERS, 1972

John Mathes & Associates, Inc.	
GENERALIZED CROSS SECTION THROUGH THE ARKANSAS RIVER VALLEY IN THE SITE VICINITY	
12862459	FIGURE 3

Subsurface soil was sampled during drilling of all monitoring wells and borings. In summer of 1986, soil gas samples were collected and analyzed at 87 locations. The results of these analyses were used in selecting some phase II boring and monitoring well locations.

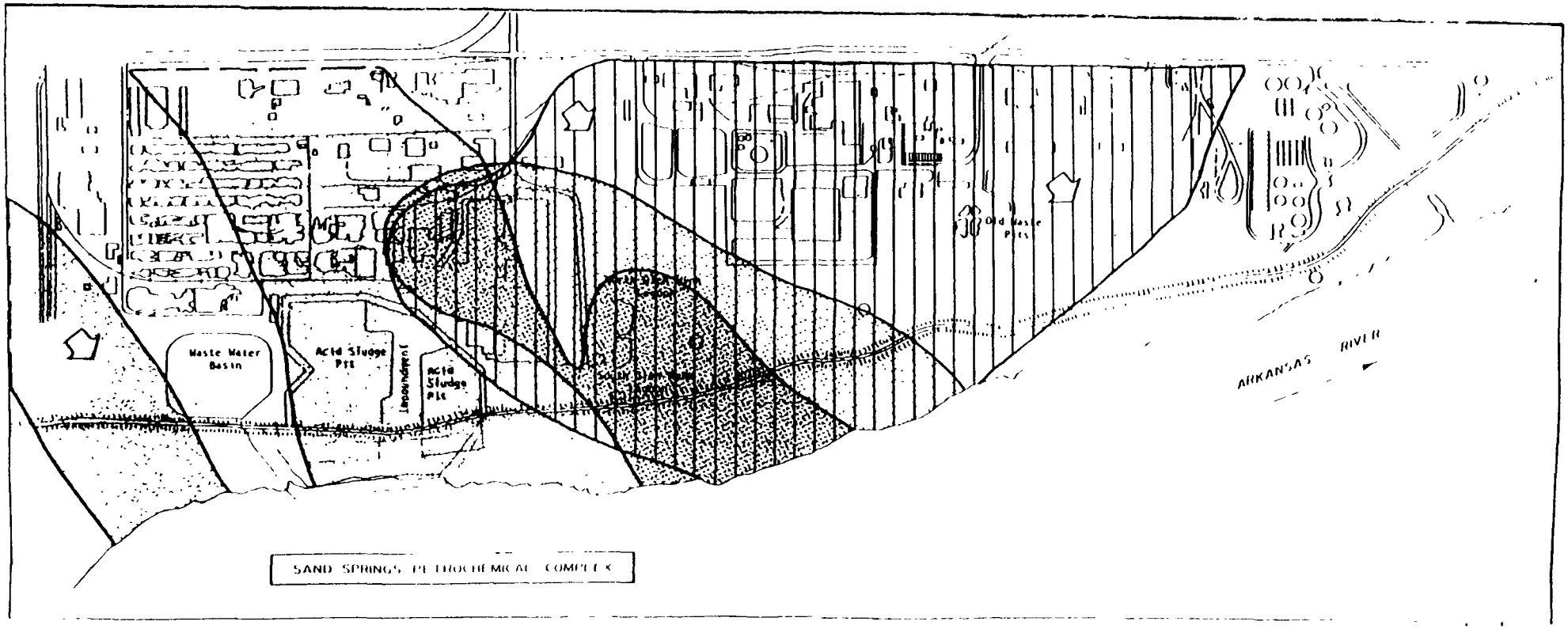
The extents of the plumes (Figure 4) of contaminated groundwater and areas of contaminated soils were estimated based on monitoring well and boring data. Table 1 shows the maximum groundwater concentrations for selected inorganic and organic compounds. Both surface runoff and groundwater move from the site to the adjacent Arkansas River. The impact on Arkansas River water quality has been determined to be insignificant. This conclusion is based on actual sampling of the river and on computer modeling performed by the Oklahoma Water Resources Board (FY-85 Water Quality Management Plan, 1986).

Inorganic priority pollutant compound contamination was found to be widespread. Most sampled areas on-site, including background monitoring wells, were contaminated to some extent. Smelter slag wastes, (normally high in metals) used as fill in the area for several decades may have leached and created the metal concentrations detected in the soil and groundwater samples. Concentrations of barium in soil and groundwater may have been caused by disposal of drilling muds containing barium, orginating from extensive oil and gas well drilling in the area. Due to the high background concentrations of inorganics, the alluvial aquifer in the area of the site could be classified as a Class III or unuseable aquifer.

Based on studies of site use, it appears that much of the base-neutral organic priority pollutants found on-site are the result of oil contamination. A source of subsurface petroleum hydrocarbons appears to have been leakage from the former refinery tank farm and processing areas. The lateral movement of the oil plume is apparently small because migration of the plume beyond the boundaries of the former refinery and waste pit areas does not appear to have occurred.

The groundwater contaminant plumes of volatile organic priority pollutants have originated from several sources, some of which are located upgradient of the site. The origin of the upgradient plumes is unknown. The source of the on-site plume appears to be from soil contamination and lagoons at the Glenn Wynn site, as indicated in Figure 5.

Although the nearest residential drinking water wells are approximately one mile northeast of the site, these wells are not downgradient of the site since the site groundwater discharges southeast to the Arkansas River. The USEPA's Field Investigation Team collected samples for metals analysis from seven of the residential drinking water wells in December of 1980. Significant concentrations were not detected in these samples. A full chemical analysis was performed on three of the residential wells in September 1987 and the sample results showed that no contaminants were detected. Should these residential drinking water wells ever become contaminated from some upgradient source, a municipal water system is available in the neighborhood.



EXPLANATION

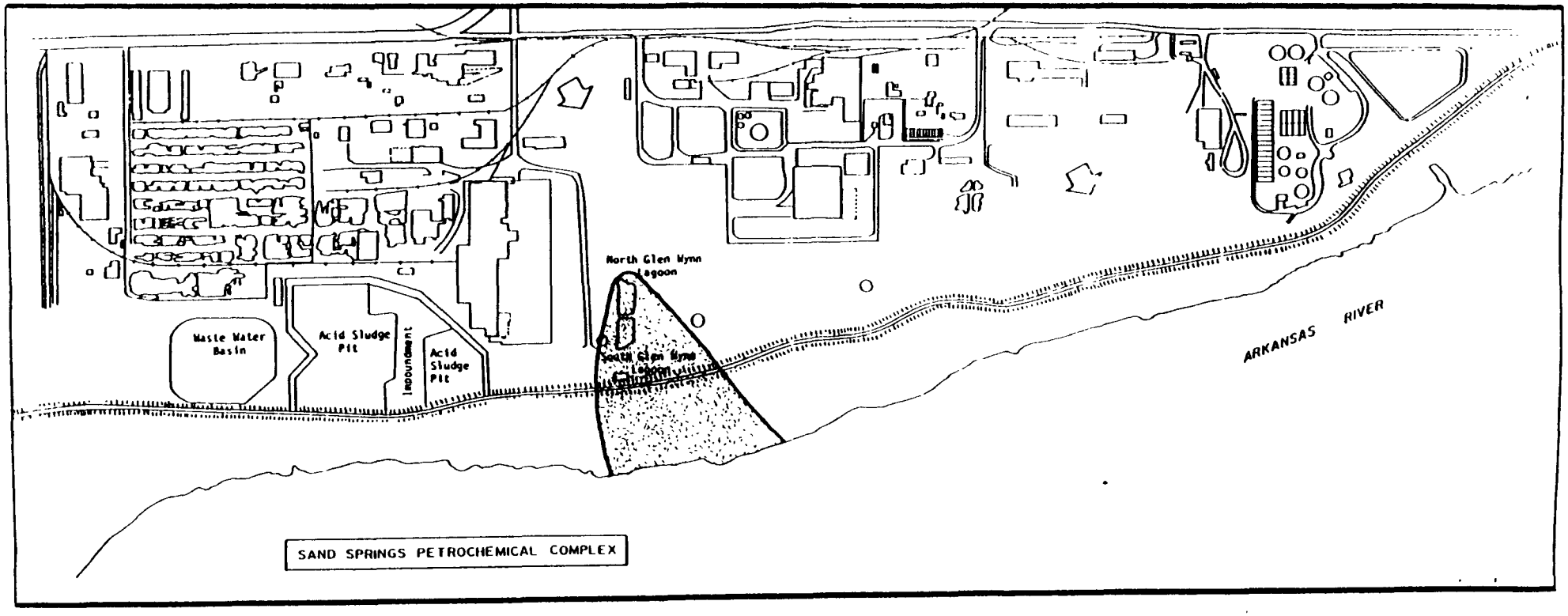
- ESTIMATED EXTENT OF GROUNDWATER WITH BASE-NEUTRAL EXTRACTABLE ORGANIC PRIORITY POLLUTANTS GREATER THAN 15 ug/L
- ESTIMATED EXTENT OF GROUNDWATER WITH VOLATILE ORGANIC PRIORITY POLLUTANTS GREATER THAN 15 ug/L
- ESTIMATED EXTENT OF OIL-CONTAMINATED ALLUVIAL DEPOSITS
- ESTIMATED DIRECTION OF GROUNDWATER FLOW

SOURCE John Mathes & Associates, Inc., 1988.

0 400 800
SCALE IN FEET

N

John Mathes and Associates, Inc	
ESTIMATED EXTENT OF SUBSURFACE ORGANIC POLLUTANTS	
12862459	FIGURE 4



EXPLANATION

ESTIMATED DIRECTION OF GROUNDWATER FLOW

APPROXIMATE LOCATION OF CONTAMINANT PLUME ASSOCIATED WITH GLEN WYNN LAGOON AREA

0 400 800
SCALE IN FEET

N

John Mathes and Associates, Inc.

APPROXIMATE LOCATION OF CONTAMINANT PLUME SAND SPRINGS MAIN SITE

12862459 | FIGURE 5

A more detailed description of the analytical results can be found in the Sand Springs Petrochemical Complex "Main Site" Remedial Investigation Report.

Because of the petroleum exclusion under the Comprehensive Environmental Response Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act (Section 101 (f)) the subsurface oil contamination at this site cannot be dealt with as a Superfund waste. Those plumes of groundwater contamination which appear to be originating from off-site or from active facilities will undergo further investigation in consultation with the Oklahoma State Department of Health Preliminary Assessment/Site Inspection Program and the Resource Conservation and Recovery Act Program. Because of these findings the "Main Site" Feasibility Study and this Record of Decision deals primarily with the groundwater contamination associated the "Glenn Wynn area" of the site.

Potential Impacts of the Site on Human Health and the Environment

Groundwater has been contaminated directly by the Glenn Wynn lagoons and indirectly by runoff from the site, however, following the Source Control Remedial Action, groundwater quality is anticipated to improve. Relatively clean sands were found beneath the main waste deposits above underlying groundwater, indicating that direct contamination by the main waste deposits is not significant. Discharge of the Glenn Wynn "plume" to the Arkansas River has not proved to be a degradation to surface water quality, based on the sampling conducted during the Remedial Investigation. Also, sediment sampling adjacent to the Glenn Wynn area did not indicate significant contamination.

Based on the information gathered in studies of the site, EPA has concluded that the groundwater and minimally contaminated soils on the site pose no significant risks to human health and the environment. Attached correspondence (Appendix B) from the Agency for Toxic Substances and Disease Registry (ATSDR) concurs with this finding. Sampling of area residential wells and the Arkansas River has not detected any contamination from the site. Primary drinking water is supplied by Lake Spavinaw and Lake Eucha in Delaware county northeast of Tulsa on the Grand River system. Also, following the Source Control Remedial Action, no risks to human health and the environment are expected to exist via the direct contact, air emissions or surface water exposure routes.

II. ENFORCEMENT

Background

Approximately 700 Potentially Responsible Parties (PRPs) have been identified at the site. Special notice was given to ARCO to conduct the Source Control Operable Unit Remedial Design and Action. A consent decree has been finalized and will be forwarded to the Department of Justice for lodging with the court.

To date, two PRPs have taken action at the site; ARCO and the Sand Springs Home. The Sand Springs Home, performed a removal action in 1984 under the terms of a Unilateral Administrative Order. ARCO conducted soldification and incineration waste treatability studies under an Administrative Order.

III. COMMUNITY RELATIONS HISTORY

Investigations at the Sand Springs site focused on two areas of study, the Source Control Operable Unit and the Main Site Operable Unit (groundwater and soils). On July 24, 1984, EPA announced through a press release that funds were available to the Oklahoma State Department of Health to conduct studies at the site. The Source Control study was subject to a public comment period and public meeting during August 1987. The Record of Decision was signed on September 29, 1987. The Main Site study was completed in the Spring of 1988. On March 24, 1988, OSDH announced via a press release that the Remedial Investigation was available in repositories for public review. On May 4, 1988, EPA announced through a press release that the public comment period on the Main Site Remedial Investigation Feasibility study would be held between May 9 and June 7, 1988. Also the press release announced that a public meeting to discuss the proposed remedy would be held at the Sand Springs Municipal Building on May 24, 1988.

The press release and an EPA prepared fact sheet describing the various remedial alternatives and the EPA preferred alternative was mailed to the site mailing list. The fact sheet provided a brief history, described the remedy selection process, listed the remedial alternatives and provided details about the public comment period and public meeting.

On May 24 at 3:00 p.m. EPA and OSDH representatives briefed the Mayor, Members of the City Council, the City Manager, other members of the city and staff and representatives of civic organizations on the proposed remedy. All those present agreed with EPA's preferred alternative.

The public meeting began at 7:00 p.m. About 65 people were in attendance. All speakers at the meeting agreed with EPA's preferred alternative, including the Oklahoma State Department of Health, the city of Sand Springs, the Sand Springs Chamber of Commerce and interested citizens. A request was made to extend the public comment period. However, EPA later determined that since all communication efforts were made to provide adequate notice about the comment period and that the parties making the request agreed with the proposed remedy, there was no need to extend the public comment period. The meeting adjourned at 7:45 p.m. No additional comments were submitted during the public comment period, however comments which were received prior to this Record of Decision are responded to in Appendix E.

IV. ALTERNATIVES EVALUATION

Evaluation Criteria

To ensure compliance with Section 121(a)(b) and (d) of the Superfund Amendments and Reauthorization Act, the following nine factors are considered in selecting a remedy for a Superfund site. These are summarized below:

1. Consistency with Other Environmental Laws (ARARs)

In determining appropriate remedial actions at Superfund sites, consideration must be given to the requirements of other Federal and State environmental laws, in addition to CERCLA as amended by SARA. Primary consideration is given to attaining applicable or relevant and appropriate Federal and State public health and environmental regulations and standards. Not all Federal and State environmental laws and regulations are applicable to each Superfund response action. The compliance of each remedial alternative with all applicable or relevant and appropriate environmental laws is shown in Table 4.

2. Reduction of Toxicity, Mobility or Volume

The degree to which alternatives employ treatment that reduces toxicity, mobility, or volume must also be assessed. Relevant factors are:

- o The treatment processes the remedies employ and materials they will treat;
- o The amount of hazardous materials that will be destroyed or treated;
- o the degree of expected reduction in toxicity, mobility, or volume;
- o The degree to which the treatment is irreversible;
- o The residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity for bioaccumulation of such hazardous substances and their constituents.

3. Short-term Effectiveness

The short-term effectiveness of alternatives must be assessed; considering appropriate factors among the following:

- o Magnitude of reduction of existing risks;

- o Short-term risks that might be posed to the community, workers, or the environment during implementation of an alternative including potential threats to human health and the environment associated with excavation, transportation, and redisposal or containment;

- o Time until full protection is achieved.

4. Long-term Effectiveness and Permanence

Alternatives are assessed for the long-term effectiveness and permanence they afford along with the degree of certainity that the remedy will prove successful. Factors considered are:

- o Magnitude of residual risks in terms of amounts and concentrations of waste remaining following implementation of a remedial action, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents;

- o Type and degree of long-term management required, including monitoring and operation and maintenance;

- o Potential for exposure of human and environmental receptors to remaining waste considering the potential threat to human health and the environment associated with excavation, transportation, redisposal, or containment;

- o Long-term reliability of the engineering and institutional controls, including uncertainties associated with land disposal of untreated wastes and residuals;

- o Potential need for replacement of the remedy.

5. Implementability

The ease or difficulty of implementing the alternatives are assessed by considering the following types of factors:

- o Degree of difficulty associated with constructing the technology;

- o Expected operational reliability of the technologies;

- o Need to coordinate with and obtain necessary approvals and permits (e.g., NPDES, Dredge and Fill Permits for off-site actions) from other offices and agencies;

- o Availability of necessary equipment and specialists;

- o Available capacity and location of needed treatment, storage, and disposal services.

6. Cost

The types of costs that should be assessed include the following:

- o Capital cost;
- o Operation and maintenance costs;
- o Net present value of capital and O & M costs;
- o Potential future remedial action costs.

7. Community Acceptance

This assessment should look at:

- o Components of the alternatives that the community supports;
- o Features of the alternatives about which the community has reservations;
- o Elements of the alternatives which the community strongly opposes.

8. State Acceptance

Evaluation factors include assessments of:

- o Components of the alternatives the State supports;
- o Features of the alternatives about which the State has reservations;
- o Elements of the alternatives under consideration that the State strongly opposes.

9. Overall Protection of Human Health and the Environment

Following the analysis of the remedial options against individual evaluation criteria, the alternatives are assessed from the standpoint of whether they provide adequate protection of human health and the environment considering the multiple criteria.

EPA is also directed by SARA to give preference to remedial actions that utilize treatment to remove contaminants from the environment. Off-site transport and disposal without treatment is the least preferred option where practicable treatment technologies are available.

Description of Alternatives

In conformance with the National Contingency Plan, initial remedial approaches were screened to determine which might be appropriate for dealing with groundwater contamination at the site. (See the Feasibility Study for details of this evaluation). The Source Control Remedial Action as described in the September 1987 Record of Decision was given consideration during development of the groundwater remediation alternatives. The Source Control Remedial Action will be performed prior to implementation of any selected groundwater alternative. The estimated duration and costs for each alternative was based on remediation to background concentrations of contaminants found in upgradient monitoring wells. Each groundwater remedial action alternative would require treatability studies to determine effectiveness and the capabilities of each technology for remediating contaminated groundwater at the site. From the initial remedial approaches four alternatives were chosen for more detailed evaluation and comparison with the remedy selection criteria outlined above. As previously mentioned, these alternatives deal with groundwater contamination associated with the Glenn Wynn area of the site. Each is summarized below:

ALTERNATIVE 1, No Action, consists of monitoring the site following the Source Control Remedial Action. The No Action alternative is included to evaluate the groundwaters degree of threat to public health and the environment following the Source Control Remedial Action and for comparison with all other alternatives. Included in the no action alternative is the placement of appropriate warning signs, restricting access and the collecting and analyzing of groundwater and Arkansas River samples for a period of 30 years. The cost of this alternative is approximately $440,000.

ALTERNATIVE 2, Bioreclamation, consists of interception of groundwater upgradient of the Glenn Wynn lagoons, addition of nutrients and an oxygen source around the lagoon area, enhanced biodegradation of groundwater contaminants insitu, removal of a major portion of the groundwater flow at the levee for recycling to the lagoon area, and the natural flow of remediated groundwater to the Arkansas River system. Venting of the subsurface soil above the groundwater would also be performed. Because of the need for bench-scale treatability studies for design of a bioreclamation system, engineering was estimated to be 15 percent of construction costs for this alternative.

Bioreclamation is estimated to require five years to remediate the subsurface soil and groundwater. The estimated cost of this alternative is approximately $7.9 million dollars.

ALTERNATIVE 3, Biological Treatment, consists of removing the groundwater downgradient of the Glenn Wynn lagoon area and biologically treating the contaminated groundwater in an activated sludge reactor. Venting of the subsurface soil above the groundwater would also be performed. Groundwater would be removed using a subsurface collection system downgradient of the Glenn Wynn lagoon area. The water would be pumped from

the lift station at an estimated rate of 100 GPM to a hydrocarbon/water separator, then to a flow equalization tank. The water would be pumped to the activated sludge reactor, passed through a clarifier, and filtered prior to discharge to the Arkansas River.

Alternative 3 is estimated to require 10 years to complete. Treatability studies would be necessary to determine the technology's effectiveness on the sites contaminated groundwater. The estimated cost of this alternative is approximately $7.3 million.

ALTERNATIVE 4, Physical Treatment, consists of removing groundwater downgradient of the Glenn Wynn lagoon area with a subsurface collection system and treating it in physical treatment units before discharging it to the Arkansas River. This alternative involves filtration, air stripping and carbon adsorption. Venting of the subsurface soil is also included in this alternative.
Applicable regulatory standards would be attained for Alternative 4. The treatment units would be sized to achieve acceptable effluent concentrations at a groundwater flow rate of 100 GPM. The estimated duration of remediation using Alternative 4 is 10 years. The estimated cost of this alternative is approximately $7.3 million.

Evaluation of Alternatives

The degree that the four groundwater remedial alternatives meet the nine selection criteria is contained in Table 3. The groundwater remedial alternatives are evaluated taking into consideration the approved Source Control Remedial Action. The following values were assigned to compare remedial selection criteria:

+ Alternative would exceed a criterion in comparison to other alternatives.

0 Alternative can be designed to meet the selection criterion.

- Special efforts will be necessary in the design of the remedy to meet the selection criterion.

The rationale for the ratings assigned in this table is as follows:

1. Complies with ARARS (i.e. meets or exceeds Applicable, or Relevant and Appropriate Federal and State Requirements).

   a. No Action (monitoring the groundwater following the Source Control Remedial Action) was assigned "0" because following the Source Control Remedial Action it is anticipated that the natural flushing action of the alluvial aquifer will decrease the level of groundwater contamination over time. Sampling of the Arkansas River was unable to detect contamination from the site and a "worst case" computer modeling of the Glenn Wynn plume indicated that, although undetected, the hypothetical discharge would be 4.6 times less than NPDES regulatory standards. Primary drinking water is supplied by

Lake Spavinaw and Lake Eucha on the Grand River System northeast of Tulsa. Based on sampling, residential wells within one mile of the site have not been affected and are not anticipated to be impacted based on the direction of groundwater flow, which is towards the Arkansas River. Long term (at least 30 years) monitoring would be conducted to ensure the effectiveness of the remedy.

b. All treatment alternatives (Insitu Bioreclamation, Biological Treatment and Physical Treatment) were also rated "0" because each alternative could be designed to meet the applicable or relevant and appropriate Federal and State regulatory requirements.

2. Reduces: Toxicity, Mobility, and Volume

No Action (monitoring following the Source Control Remedial Action) and all treatment alternatives (Insitu Bioreclamtion, Biological Treatment and Physical Treatment) were rated "+" because each alternative, although in varying degrees, would reduce each of these parameters. Because the major sources of contamination will be removed, the natural flushing action of the alluvial aquifer will reduce groundwater contamination over time, therefore the "No Action" alternative meets these parameters. All treatment alternatives could potentially reduce mobility, toxicity and volume based on previous applications of the technologies, however treatability studies would be required to determine the level of effectiveness on the particular contamination at the site.

3. Short term Effectiveness

The "No Action" (monitoring following the Source Control Remedial Action) was rated "0" in relation to the treatment alternatives, which were rated "+", because of the relative differences in time between the natural flushing action of the alluvial aquifer versus the active pumping associated with the treatment alternatives.

4. Long-term Effectiveness

Because the natural flushing of the alluvial aquifer associated with the "No Action" alternative and all treatment alternatives can potentially reduce groundwater contamination effectively in the long term, each alternative was rated "+".

5. Implementability

The "No Action" (monitoring following the Source Control Remedial Action) and Physical Treatment alternatives were both rated "+" relative to the other treatment alternatives because of their known effectiveness and predictability based on previous applications. The Insitu Bioreclamation and Biological Treatment alternatives were rated "-" because of the unknown level of effectiveness of any biological technology on the particular groundwater contamination at the site.

6. Cost

Estimated cost for each remedial action alternative are summarized in Table 2. Included in this table are total capital and implementation costs, annual operation and maintenance costs, total present worth and replacement costs. Replacement costs are included to evaluate the costs involved if the alternative were to fail and replacement of equipment associated with each remedy was necessary. Replacement costs for each treatment alternative are approximately $3 million. Replacement costs associated with the "No Action" alternative is approximately $8,000. The present worth of the "No Action" (monitoring following the Source Control Remedial Action) alternative is approximately $440,000. All treatment alternatives are estimated to cost $7-8 million.

7. Community Acceptance

Based on the favorable public responses at the public meeting and during the public comment period the "No Action" (monitoring following the Source Control Remedial Action) was rated "+" and all treatment alternatives were rated "0".

8. State Acceptance

The State of Oklahoma concurs with the selected remedy (See Appendix D). Therefore, the "No Action" (monitoring following the Source Control Remedial Action) alternative was rated "+" and all treatment alternatives were rated "0".

9. Overall Protection of Human Health and the Environment

The "No Action" (monitoring following the Source Control Remedial Action) alternative and all treatment alternatives were rated "+". Each treatment alternative, including the natural flushing of the alluvial aquifer associated with the "No Action" alternative can potentially reduce groundwater contamination. Sampling of area residential wells and the Arkansas River has not detected any contamination from the site.

The long term monitoring (at least 30 years) of the groundwater which is including in the "No Action" alternative would ensure effectiveness of the remedy.

V. SELECTED REMEDY: No Action (monitoring following the Source Control Remedial Action)

Rationale

Based upon the findings of the RI/FS, the Endangerment Assessment for this operable unit concluded there are no public health threats from the minimally contaminated soil, groundwater, or the Arkansas River. The groundwater and the Arkansas River are not sources of

drinking water and sampling of the Arkansas River detected no contamination. Considering these findings the selected remedy for this operable unit is No Action (monitoring following the Source Control Remedial Action). A "worst case" computer modeling of the site indicated that, although undetected, the hypothetical discharge would be 4.6 times less than NPDES regulatory standards. Primary drinking water is supplied by Lake Spavinaw and Lake Eucha on the Grand River System northeast of Tulsa. Based on sampling, residential wells within one mile of the site have not been affected and are not anticipated to be impacted based on the direction of groundwater flow, which is towards the Arkansas River.

Included as part of this remedial action is the placement of appropriate warning signs, restricting access and collecting and analyzing groundwater and Arkansas River samples for a period of at least 30 years. Potential offsite and/or active facilities which appear to be contributing to groundwater contamination in the area of the site will be further investigated in consultation with the Oklahoma State Department of Health. If, after the source control remedial action, as described in the September 1987 Source Control Record of Decision, monitoring reveals that the site releases contamination such that groundwater or the Arkansas River is adversely impacted, then further action will be considered. If no trend toward adverse impacts is detected, deletion of the site from the National Priorities List will be pursued.

This alternative is protective and cost-effective and attains applicable or relevant and appropriate Federal and State standards. It is determined that this remedial approach is permanent and the use of alternative treatment technologies have been utilized to the maximum extent practicable.

Consistency with the National Contingency Plan (NCP) and the Provisions of the Superfund Amendments and Reauthorization Act of 1986 (SARA)

The No Action remedy in conjuction with the previously approved source control remedial action (September 1987 Source Control Record of Decision) provides adequate protection of public health, welfare, and the environment. This approach is also consistent with the National Contingency Plan (NCP), 40 CFR 300.68(h)(2)(iv) and (vi) (Federal Register, 1985) which requires:

(iv) An assessment of each alternative in terms of the extent to which it is expected to effectively mitigate and minimize threats to and provide adequate protection of public health, welfare and the environment.

(vi) An analysis of any adverse environmental impacts, methods for mitigating these impacts, and costs of mitigation.

Additionally, the long-term effectiveness factors cited in SARA Section §121(b)(1) have been considered. These include:

A) The long-term uncertainties associated with land disposal;

B) The goals, objectives, and requirements of the Solid Waste Disposal Act;

C) The persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents.

D) Short- and long-term potential for adverse health effects from human exposure;

E) Long-term maintenance cost;

F) The potential for future remedial action costs if the remedial action in question were to fail; and

G) The potential threat to human health and the environment associated with excavation, transportation, and redisposal, or containment.

Operation and Maintenance (O&M)

The need for future operation and maintenance will be minimized since the sources of the contamination will be treated as indicated in the September 1987 Source Control Record of Decision. Site operation and maintenance will include a monitoring well and Arkansas River sampling and analysis program. Additional site maintenance will entail inspection of the site, periodic repair of the perimeter fencing, and monitoring associated with the Source Control Remedial Action.

Future Actions

The proposed remedial action for the site is considered permanent. If, however, significant, unforeseen, off-site migration or contamination occurs as a result of the site, appropriate remedial measures will be taken.

Based on the studies conducted it appears that potential off-site and/or active facilities are contributing to groundwater contamination in the area of the site. Further investigations are being conducted in consultation with the Oklahoma State Department of Health Preliminary Assessment/Site Inspection Program and the Resource Conservation and Recovery Act Program to identify these sources of contamination.

Schedule*

Approve Remedial Action (sign ROD)	June 1988
Complete Enforcement Negotiations	October 1988
Start Remedial Design	October 1988
Complete Design	March 1989
Start Remedial Action	March 1989

* This schedule coincides with the schedule outlined in the September 1987 Source Control Record of Decision.

APPENDIX A

TABLE 1

MAXIMUM GROUNDWATER CONCENTRATIONS
FOR SELECTED COMPOUNDS COMPARED
TO WATER QUALITY STANDARDS
SAND SPRINGS SITE

Parameter	MCL(a) Concentration (mg/L)	Maximum Concentration In Groundwater Samples (mg/L)	Location of Maximum Concentration
Inorganic Compounds			
Barium	1.0	98	MW10
Chromium	0.050	0.85	MW10
Arsenic	0.050	1.4	MW10
Lead	0.050	1.4	MW10
Cadmium	0.010	0.093	MW1
Mercury	0.002	0.003	MW10
Organic Compounds			
Benzene	0.005	0.26	MW4
Trichloroethylene	0.005	0.16	MW1
1,1-Dichloroethylene	0.007	0.029	MW16
1,1,1-Trichloroethane	0.20	1.4	MW1
1,2-Dichloroethane	0.005	0.24	MW1
Vinyl chloride	0.002	1.8	MW4

(a) MCL = Maximum contaminant level for drinking water under Safe Drinking Water Act.

Note: This table is for comparison purposes only. The groundwater from the Sand Springs Site is not used as a drinking water source.

TABLE 2

SUMMARY OF COST ESTIMATES FOR ALTERNATIVES

SAND SPRINGS SITE
MAIN SITE (GROUNDWATER) OPERABLE UNIT

Alternative Number and Name	Duration (Years)	Total Construction and Implementation Cost	Annual O & M Cost	Present Worth	Replacement Cost
1. No Action	30	$ 9,300	$ 45,600	$ 439,200	$ 8,000
2. Bioreclamation (Insitu)	5	$3,268,000	$1,213,200	$7,867,100	$3,000,000
3. Biological Treatment	10	$2,531,600	$ 780,100	$7,324,900	$3,000,000
4. Physical Treatment	10	$2,493,500	$ 764,400	$7,272,400	$3,000,000

TABLE 3

COMPARISON OF REMEDIAL ALTERNATIVES

SAND SPRINGS PETROCHEMICAL COMPLEX
SUPERFUND SITE
(GROUNDWATER OPERABLE UNIT)

Alternative	Complies with ARAR'S	Reduces			Effectiveness		Implement-ability	Cost $ Million		Acceptance		Overall Protect of HH & E
		MOB	TOX	VOL	Short Term	Long Term		Initial	Repl	Community	State	
1. "NO ACTION" NATURAL FLUSHING WITH MONITORING	0	+	+	+	0	+	+	.4	.008	+	+	+
2. BIORECLAMATION (INSITU)	0	+	+	+	+	+	-	8	3	0	0	+
3. BIOLOGICAL TREATMENT	0	+	+	+	+	+	-	7	3	0	0	+
4. PHYSICAL TREATMENT	0	+	+	+	+	+	+	7	3	0	0	+

Table 4

TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE ENVIRONMENTAL LAWS AND REGULATIONS FOR EACH ALTERNATIVE

SAND SPRINGS MAIN SITE

Law or Regulation	Analysis	Implementation of Alternative Meets Applicable or Relevant and Appropriate Regulations for Alternative Number			
		1	2	3	4
Federal					
Resource Conservation and Recovery Act (RCRA)*	Implementation of this alternative will be consistent with current RCRA regulations and land disposal restrictions including standards for owners and operators of hazardous waste treatment, storage, and disposal facilities and closure performance standards.	Yes	Yes	Yes	Yes
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	Implementation of this alternative is consistent with appropriate remedial actions and removal operations.	Yes	Yes	Yes	Yes
Superfund Amendments and Reauthorization Act (SARA)	Implementation of this alternative meets the objectives of SARA.	Yes	Yes	Yes	Yes
Department of Transportation (DOT) Hazardous Materials Transport Rules	Implementation of this alternative may include the off-site transport of hazardous materials. The transport of these materials will be in compliance with these rules, including use of properly constructed and marked transport vehicles, use of a licensed transporter, and use of hazardous waste manifests.	N/A	Yes	Yes	Yes
Clean Air Act (CAA) and National Ambient Air Quality Standards (NAAQS)	Implementation of this alternative will comply with federal emission standards.	Yes	Yes	Yes	Yes

* RCRA requires that contamination either be removed to background concentrations or other standard protective of human health or the environment (closure as a storage unit by removal) or capped (closure in place as a landfill).

Table 4 Continued

TABLE OF APPLICABLE OR RELEVANT AND APPROPRIATE ENVIRONMENTAL LAWS AND REGULATIONS FOR EACH ALTERNATIVE

SAND SPRINGS MAIN SITE

Law or Regulation	Analysis	Implementation of Alternative Meets Applicable or Relevant and Appropriate Regulations for Alternative Number			
		1	2	3	4
National Pollutant Discharge Elimination System (NPDES) Requirements	Implementation of this alternative will result in a point source discharge. NPDES standards must be met.	N/A	Yes	Yes	Yes
Clean Water Act	Implementation of this alternative will result in compliance with Federal Water Quality Criteria in surface water.	Yes	Yes	Yes	Yes
Executive Orders (EO) for Flood Plains	Implementation of this alternative will occur in a floodplain as defined in EO-11988.	Yes	Yes	Yes	Yes
State					
Oklahoma Solid Waste Regulations	Implementation of this alternative will comply with Oklahoma regulations for solid wastes.	N/A	Yes	Yes	Yes
Oklahoma Clean Air Act	Implementation of this alternative may result in the emission of toxic substances into the air during treatment.	N/A	Yes	Yes	Yes
Underground Injection Control Rules	Implementation of this alternative will comply with these regulations.	N/A	Yes	N/A	N/A
Oklahoma Water Quality Standards	Implementation of this alternative will result in compliance with Oklahoma water quality criteria for surface water.	Yes	Yes	Yes	Yes

N/A = Not applicable.

APPENDIX B

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

MEMORANDUM

Date: April 29, 1988

To: Mr. Paul Sieminski, RPM
ALONM Remedial Section (6H-SA)

From: Senior Regional Representative
ATSDR-Regional Office for Health Response

Subject: Health Consultation - Sand Springs NPL Site
Sand Springs, Oklahoma OKD980748446 (HEOSSS.04)

The Agency for Toxic Substances and Disease Registry (ATSDR) has been requested to review and comment on the Environmental Protection Agency, Regic VI, recommended no action alternative for groundwater issues at the above referenced site. The draft Sand Springs Endangerment Assessment, Addendum 1 (groundwater and soils) was provided for this review.

The findings presented have been prepared with the assistance and concurrence of the Emergency Response Branch, Office of Health Assessment, ATSDR.

SUMMARY:

Sand Springs Petrochemical (SSP), which occupies approximately 200 acres, is bounded on the north by the Sand Springs, Oklahoma, township and on the south by the Arkansas river. Most of the 17,000 residents of Sand Springs reside within 3 miles of this site and 300 of them work on or adjacent to the SSP site. The groundwater has been identified as being heavily contaminated with metals (arsenic, barium, cadmium, chromium and lead) and organics (benzene, TCE, and vinyl chloride). The groundwater flow is southeastward to the Arkansas River. Data reveals that these contaminants have been identified in elatively high levels in groundwater at this site; however, the level of contaminants that are migrating into the Arkansas River appear to be negligible and not influencing the river or downstream private wells that are in essenc upgradient to this site.

Contaminants that have been identified from the SSP site are constituents th have been identified in the various medias at this site. In addition, compounds that are not related to this site have been identified in groundwater sampling investigations and, therefore, appear to be offsite migration from unknown facilities north and northeast of this SSP site. Therefore, a need for identification of all facilities that are contributing to this groundwater contamination requires more complete characterization.

RECOMMENDATION:

In evaluating these data it is the opinion of ATSDR that the proposed no action with monitoring alternative following the source control removal acti is appropriate for the site. At the time of the identification of additiona facilities that are or have been contributing to the influence of groundwate and possible other media, an evaluation of offsite conditions and potential remedial alternatives should be considered.

ATSDR appreciates the opportunity to comment on the EPA proposed alternative for the SSP site and would request to be kept appraised of future action from this site.

REVIEWERS:

Mark McClanahan
Carl Hickam

Carl R. Hickam, R.S.

cc:
George Bruner
Steve Von Allman
Mark McClanahan

APPENDIX C

demonstration board Index not included.

APPENDIX D

Joan K. Leavitt, M.D.
Commissioner

Board of Health
Linda M. Johnson, M.D.
President
Ernest D. Martin, Ph.D.
Vice-President
Walter Scott Mason III
Secretary-Treasurer
Wallace Byrd, M.D.
John B. Carmichael, D.D.S.
Dan H. Fieker, D.C.
Burdge F. Green, M.D.
James L. Henry

OKLAHOMA STATE
DEPARTMENT OF HEALTH

P.O. BOX 53551
1000 N.E. TENTH
OKLAHOMA CITY, OK 73152

AN EQUAL OPPORTUNITY EMPLOYER

June 27, 1988

Allyn Davis (6H)
Hazardous Waste Management Division
U.S. Environmental Protection Agency
Region VI
1445 Ross Avenue
Dallas, Texas 75202-2733

Dear Dr. Davis:

The Oklahoma State Department of Health (OSDH) concurs with EPA's selected remedy, as stated in the Record of Decision for the Sand Springs Superfund site, given long term monitoring, and the implementation of the Source Control remedial action.

As presented in the public meeting, a public health threat or a significant impact to the Arkansas River was not determined. Therefore, OSDH, believes that there would be no benefit in attempting to restore the Sand Springs site groundwater at the site to its natural state.

The OSDH appreciates your help in choosing an appropriate remedy for this site.

Sincerely,

Mark L Coleman

Mark Coleman, Deputy Commissioner
Environmental Health Services

MSC/db

Oklahoma State Department of Health Official Statement

Sand Springs Superfund Site Public Meeting

May 24, 1988

Under cooperative agreements with the U.S. Environmental Protection Agency, the Oklahoma State Department of Health has completed a Remedial Investigation, Feasibility Study and Endangerment Assessment for the groundwater portion of the Sand Springs Superfund site.

During these studies, a considerable amount of data was gathered to assess the impact, if any, of groundwater from the site on public health and the environment. It was determined that groundwater at the site is not used for drinking or other purposes. The hydrogeology of the site is such that the groundwater moves directly into the Arkansas River. Samples taken from the river did not indicate any contamination. Most likely, contaminants from the site do reach the river. However, their concentration is so small and the river flow so great that they are diluted to the point of causing no impact.

Unable to find any public health threat or significant impact to the river, the Health Department believes that there would be no benefit in restoring the groundwater at the site to its natural state. Our analysis of the groundwater data indicates that many of the samples already meet Safe Drinking Water Act standards and those that do not are at lower levels than most of the current industrial discharges to the river. With this evidence, the Oklahoma State Department of Health concurs with the U.S. EPA's preferred remedy of Natural Remediation for the Sand Springs Superfund site. We commend the EPA for making what we believe to be the appropriate recommendation for the site.

APPENDIX E

Sand Springs Petrochemical Complex
Sand Springs, Oklahoma
Main Site (groundwater) Operable Unit
Responsiveness Summary

Additional information regarding community relations at the site can be found in Section III. Community Relations History of the Main Site (groundwater) Operable Unit Record of Decision.

Summary of Major Comments Received Following the Public Comment Period and EPA Responses to the Comments

1. Comment: If EPA decides to adopt a remedy other than No Action it should first consider how to address the issue of how clean is clean, since there is extensive offsite and onsite contamination.

   Response: All treatment alternatives evaluated during the Feasibility Study (FS) were based on remediating groundwater to the background concentrations found in upgradient monitoring wells 1A and MW-22. (page 4-3 of FS)

2. Comment: Although the FS excludes floating hydrocarbons and heavy metals, they would have to be removed during any other remedial effort.

   Response: The FS did not exclude floating hydrocarbons and heavy metals. The FS evaluated these parameters and determined that due to the statutory petroleum exemption and elevated background concentrations of heavy metals, subsurface hydrocarbons and heavy metals should not be specifically addressed during the detailed analysis of alternatives (page 2-16-18 of FS). Regardless of this determination the Remedial Investigation (RI) did not detect any adverse offsite impacts from these or any other groundwater contaminants.

3. Comment: Removing the soils on the Glenn Wynn portion of the site would not alleviate the soil contamination problem; the RI indicates that soil contamination similar to that found at the Wynn portion exists at other places on the site.

   Response: EPA disagrees. Although lesser amounts of soil contamination exist at other areas of the site, as indicated in the previously signed Source Control Record of Decision, a major source of contamination can be eliminated by removing heavily contaminated soils from the Glenn Wynn portion of the site.

4. Comment: By denying a reasonable extension of time within which to file comments, commentors were denied due process to adequately participate in the administrative process.

ENVIRONMENTAL PROTECTION AGENCY
DALLAS, TEXAS
LIBRARY

Response: EPA disagrees. A thirty day public comment period was provided, although only a twenty one day public comment period is required by the National Contingency Plan. In addition, separate notices were sent to the Potentially Responsible Parties to alert them to the impending decision though not required by statute or regulation. Also, all commentors, including those requesting an extension, agreed with EPA's proposed No Action (monitoring following the source control remedial action) alternative, therefore EPA found no useful purpose in formally extending the public comment period.

5. Comment: The statement made in the FS indicating that "the lateral extent of the onsite volatile organic plume which exceeds 15 ug/l is approximately 70 acres" is disproportionate to the amount of contamination actually found at the Glenn Wynn portion of the site.

Response: EPA agrees with this comment however the statement in the FS is accurate due to the fact that the 70 acres is in reference to the estimated extent of volatile organic contamination greater than 15 ug/l over the entire site, not just the Glenn Wynn area.

6. Comment: The FS (page 2-20) states that "groundwater contaminants that exceed drinking water guidelines include arsenic, lead, benzene, 1,2-dichlorethane, tetrachloroethylene and vinyl chloride." However, Table 2-2 indicates several other parameters that exceed Maximum Contaminant Level (MCL) concentrations at the site.

Response: The discussion on page 2-20 of the FS is in reference to the potential exposure pathways evaluated in the Endangerment Assessment and is not intended to be a complete discussion on overall groundwater contamination, which is found elsewhere in the document. The statement that "groundwater contaminants that exceed drinking water guidelines include..." is merely a statement to indicate that contamination is present in a potential exposure pathway.

7. Comment: One commentor disagreed with the technical approach used to reach the FS conclusions and with the assumptions made in the Endangerment Assessment.

Response: Although the commentor disagreed with the methodologies employed in reaching various FS and Endangerment Assessment conclusions, the commentor also indicated agreement with the resulting conclusions. Numerous methods of evaluation and assumptions could be made during the FS and Endangerment Assessment process which could result in the same conclusions.